

## Claims

1. Microtome, comprising:
  - a holding device with a support (3) for holding at least one portion of a processed object (4), and
  - a severing means (6, 10, 13),
  - at least one laser radiation source (10) and
  - means for focussing (6; 13) of the laser radiation, the beam focus (22) which is produced by focussing
  - being movable relative to the support (3), and
  - with a capacity to be guided to one location of the parting surface (19, 20) of the processed object (4) in order to cause severing of the material at this location,
  - there being means for pulsed delivery (14) of the beam focus to the location of the parting surface, which are set up to produce pulses with a length of action of  $< 1 * 10^{-12}$  seconds.
2. Microtome as claimed in claim 1, wherein the means for focussing (6; 13) the laser radiation are set up to move the beam focus in at least one direction of space relative to the support.

3. Microtome as claimed in claim 1 or 2, wherein there are means for guiding (12) the laser radiation to move the beam focus in at least one direction of space relative to the support.
4. Microtome as claimed in one of the preceding claims, wherein the means for focussing (6; 13) the laser radiation have a numerical aperture  $\geq 0.65$ , preferably a numerical aperture  $\geq 1.2$ .
5. Microtome as claimed in one of the preceding claims, wherein the means for pulsed delivery are set up to interrupt the beam in a pulsating manner and/or to route it away from the location of the parting surface.
6. Microtome as claimed in one of the preceding claims, wherein the means for pulsed delivery interact with the radiation source in order to interrupt the beam in a pulsating manner.
7. Microtome as claimed in one of the preceding claims, wherein there are control means (14) which
  - control the time sequence of the radiation pauses and/or which are connected to means for detecting the time sequence of the radiation pauses and/or
  - which control the relative motion between the beam focus and the support depending on the time sequence of the radiation pauses.

8. Microtome as claimed in one of the preceding claims, wherein there are control means which

- are connected to means for detecting the relative motion between the beam focus and the carrier, and
- which control the time sequence of the radiation pauses depending on the relative motion.

9. Microtome as claimed in one of the preceding claims, wherein there are means for controlling the relative motion between the support (3) and the beam focus (22) along a curved parting surface (20).

10. Microtome as claimed in one of the preceding claims, wherein there are means for observation (9, 8, 14, 15, 5, 16) of the processed object.

11. Microtome as claimed in claim 10, wherein the observation means comprise an optical microscope which can be operated using the incident light and/or transmitted light process.

12. Microtome as claimed in claim 10 or 11, wherein the observation means contain means (9, 14) for display of at least one portion of the processed object using backscattered laser radiation.

13. Microtome as claimed in claim 12, wherein the display means comprise the following:

- a detector (9) for detection of the radiation which has been backscattered from a portion of the processed object,
- means for detection (9) of the coherent radiation which has been reflected from the reference plane, and

- means for producing (9; 14) an image display of a portion of the processed object by means of superposition of the laser radiation which has been backscattered from the portion of the processed object and the coherent radiation which has been reflected from the reference plane.

14. Process for microtomy of processed objects (4), with the following steps

- holding of at least one portion of the processed object by a support (3) of a holding device,
- at least partial severing of the processed object by a cutting means,

wherein

- laser radiation (11) is released from a radiation source (10) which is assigned to the cutting means and
- this laser radiation is focussed and the beam focus (22) is routed in a pulsating manner to a location of the parting surface (19; 22) of the processed object in order to produce material severing at this site, the beam focus (22) relative to the support (3) being moved in two or three directions of space so that the processed object is microtomed.

15. Process as claimed in claim 14, wherein the length of action of a pulse is  $< 1 * 10^{-12}$  seconds.

16. Process as claimed in one of claims 14 to 16, wherein the beam focus is guided along a curved surface (20).

17. Process as claimed in claim 14, wherein the sequence of pulses and the relative

motion between the support and the beam focus in time to one another are controlled.

18. Process as claimed in one of claims 14 to 17, wherein the parting surface is predetermined prior to the cutting process and the beam focus is guided automatically along this parting surface.

19. Process as claimed in claim 18, wherein prior to the cutting process an image of at least one portion of the processed object is prepared by means of an optical microscopy imaging process and the parting surface is predetermined using this image.

20. Process as claimed in claim 18, wherein prior to the cutting process an image of at least one portion of the processed object is prepared by means of the process of optical coherence tomography and the parting surface is predetermined using this image.

21. Process as claimed in one of claims 14 to 18, wherein during the cutting process an image of at least one portion of the processed object is prepared by means of an optical microscopy imaging process and/or the process of optical coherence tomography is prepared and a reproduction of this image is made available to the user, using which he can guide the beam focus.

22. Process as claimed in one of claims 14 to 21, wherein in a first phase of the cutting process one or more regions of the parting surface which are spaced apart from one another are severed and in the last phase of the cutting process complete severing along the parting surface takes place by severing the areas which lie between the spaced regions.

23. Use of a device comprising the following

- a holding device with a support (3) for holding at least one portion of a processed object (4), and
- a severing means (6, 10, 13),

- at least one laser radiation source (10) and
- means for focussing (6; 13) of the laser radiation, the beam focus (22) which is produced by focussing
- being movable relative to the support (3), and
- having a capacity to be guided to one location of the parting surface (19, 20) of the processed object (4) in order to cause severing of the material at this location, for microtomy of a processed object.